

CHARLES UNIVERSITY

Faculty of Physical Education and Sport

Department of Physiotherapy

CASE STUDY OF A PATIENT WITH AN ACUTE INFLAMMATORY  
DEMYELINATING POLYNEUROPATHY

GUILLAIN – BARRÉ SYNDROME

BACHELOR THESIS

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**Declaration:**

I declare that this Bachelor Thesis has been based entirely on my own individual work and on my own practice that took place in Ústřední Vojenská Nemocnice in Prague from 11/01/2010 till 22/01/2010. All the information used for the development of this Bachelor Thesis has been taken from the list of literature that exists in the end of this Thesis.

In Prague

Stella Fotiou

## **Abstract:**

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Title: Case study of a patient with an acute inflammatory demyelinating polyneuropathy, Guillain- Barré Syndrome

Title in Czech: Guillainův - Barréův syndrom

Supervisor: Mgr. Kateřina Maršáková

Work Place: Ústřední Vojenská Nemocnice (UVN)

Work Period: 11<sup>th</sup> to 22<sup>nd</sup> of February, 2010

Guillain-Barré syndrome (GBS) is the most common cause of acute neuromuscular paralysis in developed countries, as noted by Meythaler JM. (1997) [1]. The syndrome is rare but can occur in anyone despite the age or gender. Most commonly it can be found in elderly people, in early adulthood, or in pregnant women usually immediately after they have given birth [2]. Moreover it is also possible to meet GBS in children, but it is significantly rarer than in adults [3]. Unfortunately the syndrome is not well known to many areas of medicine as the cases are very rare [2]. Despite this, over the years, new methods and techniques have been discovered for the treatment of the syndrome.

The treatment usually comprises exercises for patient's stability, coordination, muscle strengthening, stimulation of proprioceptors and exteroceptors, exercises to improve the breathing wave, improve movement patterns and improvement of the range of motion. Moreover the therapy includes some sessions with logo-therapists.

The thesis is divided into two parts: the General part and the Special part. The General part represents the classification of the syndrome, signs and symptoms, causes, diagnosis, management, prognosis, epidemiology and history of GBS. In the special part I present the therapy and the methods I used for my patient's recovery with the purpose of achieving the best possible results I could have had during my practice. In addition, the methodology, patient's anamnesis; the initial and final kinesiological examination, the short and long physiotherapy plan, as well as the progress and the evaluation of the effect of the therapy are also described.

I have used this plan to rehabilitate the patient during seven sessions.

Key words: Guillain-Barré syndrome (GBS), polyneuropathy, rehabilitation, physiotherapy

## Table Contents

1	Preface.....	3
2	General Part.....	4
2.1	Classification .....	4
2.2	Epidemiology.....	6
2.2.1	Campylobacter jejuni infection (Cj) .....	6
2.3	History .....	7
2.4	Signs and Symptoms .....	8
2.5	Cause.....	9
2.6	Diagnosis .....	10
2.6.1	Diagnostic Criteria .....	11
2.6.1.1	Required .....	11
2.6.1.2	Supportive .....	11
2.6.2	Differential Diagnosis .....	11
2.7	Management of syndrome .....	13
2.8	Prognosis.....	14
3	Special Part.....	16
3.1	Methodology.....	16
3.2	Anamnesis .....	17
3.3	Initial Kinesiology Examination: .....	25
3.3.1	Posture Evaluation.....	25
3.3.2	Examination of Basic Movement Patterns .....	28
3.3.3	Evaluation of Range of Motion (all joints) .....	30
3.3.4	Examination of shortened muscles: .....	32
3.3.5	Muscle strength test.....	33
3.3.6	Basic Neurological Examination.....	38
3.3.7	Special tests - Balance test .....	40
3.3.8	Palpation .....	41
3.3.9	Subjective response .....	41
3.3.10	Conclusion of examination .....	41
3.3.11	Goals of the Therapeutic Unit .....	41

3.3.12	Therapy proposal and Procedure .....	42
3.4	Short term and Long rehabilitation plan .....	43
3.5	Therapy progress .....	44
3.6	Final kinesiological Examination .....	59
3.6.1	Standing Evaluation .....	59
3.6.2	Examination of Basic Movement Patterns .....	62
3.6.3.	Evaluation of Range of Motion (all joints).....	63
3.6.4	Examination of shortened muscles .....	65
3.6.5	Muscle strength test.....	67
3.6.6	Basic Neurological Examination .....	72
3.6.8	Palpation.....	74
3.6.9	Subjective response.....	74
3.6.10	Conclusion of examination.....	74
3.7	Evaluation of the Effect of the Therapy .....	74
3.8	Prognosis.....	78
4	Conclusion .....	79
5	References.....	80
6	Supplements.....	83



## **1 Preface**

Guillain-Barré Syndrome is the most common cause of acute neuromuscular paralysis in developed countries, as noted by Meythaler JM. (1997) [13].

Guillain-Barré syndrome (GBS) is rare but can occur in anyone. It affects the nerves of the limbs and is usually triggered by an infection. Today, it is the only inflammatory polyneuropathy and the most frequent cause of acute flaccid paralysis [17], [22].

The symptoms usually start with fine paresthesia in the toes or fingertips and by weakness which involves symmetrically by several days. Because of this weakness the patient faces difficulties while he is walking or climbing stairs and the ROM decreases.

Moreover he loses his/her stability and the reflexes from the Upper and Lower extremities, but it is more difficult to regain the reflexes at his/her lower extremities. Furthermore in this case usually patients face some difficulties with their breathing. Also some disturbances of their autonomic function may appear as for example sinus tachycardia, bradycardia or hyper/hypotension [9].

The purpose of the therapy is to strengthen patient's muscles, increase the range of motion, improve his gait and stability, and try to stimulate the proprioceptors and improve patient's breathing. During the therapy it is very important to not overstress the patient and be in contact with him during the whole session of the therapy in case he feels hypotension or he does not feel well. Good and supportive care is the most important part of the treatment [17].

The therapy for the case study GBS, took place at Ústřední Vojenská Nemocnice (UVN), in Prague. The patient was fully aware about the therapy and that he was my patient for my bachelor thesis. With the patient's permission and under the lead of my supervisor for my thesis Mgr Kateřina Maršáková I carried out my work.

## **2 General Part**

### **2.1 Classification**

Guillain-Barré syndrome comprises of six main subtypes:

#### **Acute inflammatory demyelinating polyneuropathy (AIDP)**

AIDP is the most common form of GBS, and the name of it is usually used synonymously with GBS. The polyneuropathy may be acute and appear without warning or chronic and develop gradually during a longer period of time. Most often it is seen in adults than children. The symptoms are flaccid paralysis and sensory disturbances which is the block of conduction, since the axonal connection remains intact. The first attack of the disease appears directed against a component of Schwann cell surface.

In case of a severe form of AIDP, when a secondary axonal damage appears, the rate of recovery is slower in contrast with the degree of residual disability which is greater. AIDP has usually four features which are: (i) prolonged distal latencies; (ii) conduction velocity slowing; (iii) evidence of conduction block; and (iv) temporal dispersion of compound action potential [9].

#### **Miller Fisher Syndrome (MFS)**

MFS is uncommon; it may affect adults, puberty, and small children. The recovery of the syndrome can be rapid. MFS contains CNS and PNF structures, and is characterized by a rapidly evolving of the triad of ophthalmoplegia which is usually with papillary paralysis, ataxia and tendon areflexia without weakness. In the syndrome Anti-GQ1b antibodies, IgM and IgG titres which are highest during the early stage of disease. Most often these antibodies are not found in the other forms of GBS, except if there is an extra-ocular motor nerve involvement [9],[14].

#### **Acute Motor Axonal Neuropathy (AMAN) or Chinese Paralytic Syndrome**

AMAN is usually a seasonal syndrome which is common in China and Mexico. In contrast with MFS and AIDP, AMAN affects mostly children and teenagers than adults. If a primary axonal damage occur, the axons degenerate and become disconnected from the neuromuscular junctions. Accordingly the recovery comes when the axon regeneration is

complete and the recovery is rapid when the lesion is localized to pre-terminal motor branches, since the regeneration and re-innervation take place quickly. The first attack appears directed against the axolemma and motor nodes of Ranvier. The important pathological alterations are the macrophage activation, few lymphocytes, common peri-axonal macrophages, and high variable extent of axonal damage. Also the prominent auto-antibodies in AMAN are the Anti-GD1a as well as the Anti-GD3 antibodies [9], [14].

### **Acute Motor-Sensory Axonal Neuropathy (AMSAN)**

Acute motor-sensory axonal neuropathy is a rare form, similar to AMAN, where adults are mostly affected and the recovery is slow and often is incomplete. AMSAN also affects sensory nerves with severer axonal damage. The first attack of the syndrome is directed at motor nodes of Ranvier. The antibodies which are present are Anti-GM1 and the prominent pathological alterations are macrophage activation, few lymphocytes and frequent peri-axonal macrophages [9].

### **Acute panautonomic neuropathy**

Acute panautonomic neuropathy is the most uncommon variant of GBS, which sometimes is accompanied by encephalopathy and involves both the sympathetic and parasympathetic nervous system. The recovery is continuing, but often is incomplete. Some of the symptoms which may occur are impaired sweating, lack of tear formation, photophobia, nausea, dysphagia, dryness of nasal and oral mucosa, itching and peeling of skin, as well as constipation by laxatives or alternating with diarrhea. Moreover the most common symptoms are related to orthostatic intolerance, as well as gastrointestinal and sudomotor dysfunction [14].

Bickerstaff's brainstem encephalitis (BBE) Bickerstaff's brainstem encephalitis is a rare condition and the further variant of GBS. The inflammation of the brainstem results in various symptoms such as acute onset of ophthalmoplegia, ataxia, and disturbance of consciousness, hyperreflexia or Babinski's sign. BBE is usually diagnosed by magnetic resonance imaging (MRI), which plays a critical role in the diagnosis of the syndrome [23].

## **2.2 Epidemiology**

Several epidemiological studies such as sex ratio studies, age distribution and seasonality researches where done in numerous patients, who are affected by GBS despite their ethnicity, gender or age, with purpose to find the epidemiology of it [5], [20].

According to the studies the sex ratio, which is affected by GBS, is almost in all the cases biggest in males than females [5], [20]. Also, GBS appears mostly on adults and elderly people than in children, with higher a ratio in the elderly, since their normal suppressor mechanisms fail during the older age and leads to increased susceptibility to autoimmune disorders [5].

Unfortunately the studies failed to identify the relationship between the incidence of GBS and the season, despite the close association with upper respiratory tract infections, which tend to be more during the winter months in temperature climates. The lack of seasonal involvement may be due to the fact that the most frequent antecedent, respiratory and enteric infections have opposite seasonality [5].

The most frequently cause of GBS is *Campylobacter jejuni* infection (Cj), which is connected with more severe disease and prolonged disability [9]. In recently studies, the presence of antiganglioside antibodies, as antiganglioside GM1 antibodies or antiganglioside GQ1b antibodies, has been associated with axonal damage and a poorer outcome. Moreover, there has been a note between the presences of IgG anti-GD1a and anti-GM1 antibodies and a more severe presentation of GBS [13].

Despite all the research, it is still not easy to find the epidemiology of the syndrome, since no specific antibody or test of cellular immunity, exists yet to confirm or refuse the diagnosis of the GBS. Despite this GBS has been the subject of many epidemiologic studies because it is a sufficiently unusual neurologic condition that is usually serious enough to require medical attention at an early stage [5].

### **2.2.1 *Campylobacter jejuni* infection (Cj)**

*Campylobacter jejuni* is a species of bacteria commonly found in animal feces and it is one of the most common causes of human gastroenteritis. Studies have shown and association

between food poisoning caused by *Campylobacter* species and the development of GBS, which usually occurs two to three weeks after the initial illness.

*Campylobacter jejuna* infection is the predominant antecedent infection in GBS. The molecular mimicry of GM1 by several strains of *jejuna* provides a possible pathogenetic relation between *C. jejuna* infection and anti-GM1 antibody. The lipopolysaccharides of *C. jejuna* include ganglioside epitomes, such as GM1, which is similar to those in peripheral nerves. After *C. jejuna* infection, the immune response elicited to epitomes in *C. jejuna* would trigger antibody production and these antibodies, directed to *C. jejuna*, would be cross-reactive with ganglioside in the myelin sheath or axolemma, by causing the peripheral nerve injury. Nevertheless as only a small proportion of persons with *C. jejuni*-induced diarrhea subsequently develop GBS, it is considered that other factors, such as involvement of specific Cj strains or host susceptibility also play an important role in the pathogenesis of GBS [2].

## **2.3 History**

Guillain-Barre Syndrome is the most common cause of acute neuromuscular paralysis in developed countries, as noted by Meythaler JM. (1997) [13].

The (GBS) Guillain-Barre Syndrome which is known as well as Landy–Barre-Stochl syndrome, post – infectious polyneuropathy or acute idiopathic polyneuritis took its name from Dr Guillain and Dr Barre who first described this syndrome early in the last century. As noted by Wined JB (2008), Newswanger DJ, Warren CR (2004), Lannello Silvia (2004) [17], [9].

The syndrome is described as an acute acquired frequently severe, monophasic autoimmune illness of the peripheral nervous system (PNS), as well as an acute inflammatory demyelinating polyneuropathy. The most common symptoms of GBS according to the clinical picture are characterised by Gait disturbance, pain, weakness, rapidly ascending symmetric flaccid muscle paralysis, areflexia with distal involvement, and by increased cerebrospinal fluid protein without pleocytosis [9].

Moreover Guillain-Barre syndrome affects the nerves of the limbs and is usually triggered by an infection. The most known infections that are related to GBS are the *Campylobacter jejuni* which causes bowel infections and diarrhoea, Epstein Barr virus which

causes claudication fever and Cytomegalovirus which usually does not have any symptoms. GBS can also be stimulated by other infections such as HIV and Hepatitis B [17], [22].

The syndrome is rare but can occur in anyone despite the age or gender. Most commonly it can be found in people in early adulthood, in elderly people, or in pregnant women immediately after they have given birth [17]. The GBS can also be found on children but the chances are significantly lower than in adults [9].

Today is the only inflammatory polyneuropathy and the most frequent cause of acute flaccid paralysis in general medical practice. Unfortunately the syndrome is not well known to many areas of medicine as the cases are very rare [17].

Despite this, doctors, physiotherapists, logo-therapies and all the other specialists that help at patient's therapy are trying really hard in order the patient to have the opportunity of full recovery. In some cases the symptoms are very severe and the patient may die usually from respiratory deficits.

## **2.4 Signs and Symptoms**

Symptoms of GBS usually start with weakness in the Upper and Lower Extremities and moves upwards towards the center of the body. The parts of the body which are regularly more affected are the Lower Extremities (L.E.) [17]. The signs for Upper extremities (U.E.) and L.E. are fine paresthesia in the toes or fingertips which is followed by the major clinical manifestation and weakness which involves symmetrically over several days. The patient also faces difficulties with walking and stair climbing because of leg weakness. In later time some more symptoms appear such as unsteady arms, facial weakness - Bell sign, oropharyngeal weakness and lack of deep tendon reflexes [14].

Pain is usually presented either as bilateral sciatica or aching in large muscles of the upper legs, ribs or back. In cases of a severe infectious polyneuropathy, the respiration is affected and this may result in cranial nerve palsies with associated functional losses in eye movements and deglutition [17].

Moreover some disturbances of autonomic function may appear such as sinus tachycardia or even in some cases bradycardia. Also Facial flushing, fluctuating hypertension, hypotension,

loss of sweating or episode profuse diaphoresis may appear. These abnormalities are usually obvious no longer than two weeks. Moreover in autonomic symptoms may also been included problems such as with blood pressure, pulse, and bad vision [17].

At a final point the patient faces some sensory problems as tingling, numbness loss of vibration, proprioception, touch, and distal pain [14].

On the other hand Miller-Fisher may be another option which may be present with a predominance of cranial nerve findings, ataxia, areflexia, facial weakness, ophthalmoplegias, dysarthria, and dysphagia [14].

## **2.5 Cause**

GBS is known as an autoimmune disease, where the body's immune system begins to attack the body itself. The exact causes of the syndrome are not well known yet. For example no one knows why the syndrome attacks some people despite their age or gender and some others not [17], [12].

Usually the cells of the immune system attack only foreign organisms. In the case of GBS, the immune system starts to destroy the myelin sheath that surrounds the axons of several peripheral nerves, or even the axons themselves [12].

Accordingly, the myelin sheaths are injured or degraded and the nerves cannot transmit signals efficiently. Based on this the muscles start to lose their ability to respond to the brain's commands, which must be carried through the nerve network. Moreover the brain receives less sensory signals from the rest of the body, resulting in losing the ability to feel textures, heat, and pain, as well as several other sensations. In other cases, the brain may receive inappropriate signals that result in tingling or painful sensations. Because the signals which come and go from the Upper and Lower Extremities need longest distance to travel they are more sensitive to interruption. Due to this, muscle weakness and tingling sensations appear most often in the hands and feet and progress upwards [12].

However, in approximately half of all cases of GBS follows a viral or bacterial infection such as: Campylobacteriosis, common cold, Gastrointestinal viral infection, HIV, infectious mononucleosis, porphyria which is a rare disease of red blood cells and from viral hepatitis [4].

Today GBS is the only inflammatory polyneuropathy and the most frequent cause of acute flaccid paralysis in general medical practice. Unfortunately the syndrome is not well known to many areas of medicine as the cases are very rare [17].

## **2.6 Diagnosis**

An early diagnosis is very important for Guillain-Barré syndrome patients, since a proper therapeutic approach and good supporting care can decrease morbidity and increase recovery. It is necessary that the treatment for GBS will start immediately without waiting for any changes of the characteristic features of the disease. Before therapy starts it is good to have a carefully anamnesis history of the antecedent events of GBS, as well as physical examination and routine laboratory tests, to exclude any other disorders which may have similar symptoms and weakness as the GBS [9].

A necessary tool for GBS diagnosis may be the assay of anti-GM1 and IgM antibodies. Patients with short-lasting anti-GM1 elevation has a fast recovery in opposite with patients that have long-lasting anti-GM1 elevation and slow recovery [9].

Electrophysiological evaluation is important as well as nerve conduction study (NCS) which may show prolonged distal latencies, conduction slowing, conduction block and temporal dispersion of compound action potential in demyelinating cases.

Moreover in demyelinating neuropathies such as GBS it may be helpful to make a phrenic nerve conduction evaluation in detecting diaphragmatic involvement before clinical ventilator insufficiency develops. The phrenic nerve conduction study and diaphragmatic EMG are useful in detecting respiratory involvement in such patients, and to identify those with risk of respiratory failure [9].

Some other tests which were proposed for GBS are eyeball pressure testing which is used as an indicator for increasing the risk of developing a serious brady-arrhythmia, a cardiovascular autonomic test which include parasympathetic function tests and comprises heart rate responses to Valsalva maneuver; which consists of deep breathing and active changes of posture, as well as sympathetic function tests. A severe autonomic dysfunction in these patients may limit the coronary resistance and redistribution of trans-mural myocardial blood flow. At the moment the



only available techniques to visualize sympathetic innervations and evaluate the dysbalanced innervations of the myocardium are scintigraphic modalities such as the single photon emission tomography (SPECT) and the positron emission tomography (PET) with appropriate radiopharmaceuticals. Furthermore a magnetic resonance imaging (MRI) has been reported as useful for the evidence association of CNS in GBS. In addition a biopsy specimen of the motor nerve to the gracilis muscles could play a role in the diagnosis of neuromuscular disorders. At the final point psychometric evaluation plays an important role at the syndromes diagnosis [9].

## **2.6.1 Diagnostic Criteria**

### **2.6.1.1 Required**

- According to neuropathy a progressive, relatively symmetrical weakness of two or more limbs occur
- Hypereflexia

### **2.6.1.2 Supportive**

- A symmetric weakness occurs which is accompanied by numbness or tingling
- Cranial nerve involvement as for example facial nerve, as well as mild sensory involvement
- Absence of fever
- Electrophysiological evidence of demyelination from electromyogram

## **2.6.2 Differential Diagnosis**

Several difficulties usually appear in the differentiation of diagnosis in GBS, as this syndrome is not easily well-known from other neurological diseases. Its symptoms are similar or the same with other syndromes. Some of the neurological diseases which are often confused with GBS are those that include poliomyelitis, tick paralysis or cervical spine pressure, botulism or

conversion disorder. Exchange symptoms in the case of GBS are important to be suspected and searched, especially in young patients that do not respond to plasmapheresis [9].

The differential diagnosis often contains the clinical course, the pattern of weakness, transverse myelitis, myasthenia gravis, basilar artery occlusion, neoplastic meningitis, metabolic myopathies, vasculitic neuropathy, and paraneoplastic neuropathy. Some other diagnoses that may be confused with GBS are hyposphatemia, heavy-metal intoxication and neurotoxic fish poisoning [13].

Usually the symptoms which are required for diagnosis are a progressive motor weakness of more than one limb and areflexia. The present proposed electrodiagnostic criteria for GBS are for the demyelinating versions of the disease and do not cover the primary axonal variety [13].

Moreover the syndrome is more probably to be confused with the Chinese paralysis syndrome, which is known as well as non-inflammatory neuropathy. Both syndromes have bilaterally symmetrical flaccid paralysis, but the patients of GBS tend to have sensory involvement. In most of the cases of GBS occurs full recovery [9].

Chronic inflammatory demyelinating polyneuropathy (CIDP) can be also present with symptoms of GBS. Some of the patients which have inflammatory demyelinating with GBS-like, named as well as Chinese Paralytic Syndrome, have initial clinical features but with persistent symptoms similar to CIDP. According to a study, high anti-GM1 and anti GD1a IgG antibody titres are detected in GBS but not in CIDP patients. This information may play an important role for differential diagnosis [9].

Furthermore some other conditions which may affect GBS are the follow: hypokalaemic periodic paralysis, primary or secondary hyperkalaemic paralysis, thyrotoxic normokalaemic periodic paralysis, alcohol-related acute polyneuropathy, barium carbonate poisoning and some cases of post-gastrectomy polyneuropathy with thiamine deficiency[9].

In addition Diphteric neuropathy is much more similar with GBS and leads to respiratory failure, evolves more slowly, takes a biphasic course, and causes death or long term disability. Also vasculitic neuropathy or a sub-acute mononeuritis and porphyric neuropathy may also be included in the differential diagnosis, as well as a rapidly progressive polymyositis with elevated

anti-acetylcholine receptor antibody activity. At the final point a case of glioblastoma multiforme with ascending weakness has been diagnosed by mistake as GBS [9].

In conclusion a correct diagnosis and prognosis is very important for the correct treatment of the syndrome.

## **2.7 Management of syndrome**

Good and supportive care is the most important aspect of treatment [17]. The therapist should work at patient's muscle weakness, balance, gait and breathing. It is good to prepare a session of strengthening exercises for muscles weakness and coordination. Because of muscle disbalance and weakness patient's ROM may decreased, therefore the therapist needs to improve patient's range of motion as well. The therapist must assess the patient's strength and muscle pain complaints from one day to the next. It is good to evaluate the patient after a weekend of no therapy. In case the patient complains about tiredness and pain during that period of time the therapist has to change the therapy's program for a while as the patient found it too difficult. Anaerobic program is also good since GBR sufferers have problems with their breathing. The patients often require the use of resistive inspiratory training, since many of them will initially have a tracheostomy. The therapist must be careful not to over fatigue the muscles of respiration during the initial period of motor recovery unit, as this may push the patient into respiratory failure [13].

Moreover a Functional activity practice should always be included in patient's exercise regime. The Functional activity practice is practically eccentric contractions which are a way of life and are working with coordination between and within limbs [1].

Proper positioning in patients with GBS is necessary, as well as initial exercise even in the acute phases, which may include a program of gentle strengthening involving isometric, isotonic, isokinetic, manual-resistive, and progressive resistive exercises carefully tailored to the clinical condition of the patient. Orthotics should be prescribed for proper positioning and optimizing residual motor function.

Also, Aromatherapy massages were used successfully and complement the conventional nursing and the medical treatment of joint pain and constipation [9].

In addition the therapy used in cases of sensory dysfunction and pain was characterized by the prominent use of antidepressants and in some cases, the use of carbamazepine. Occasionally, in patients who have unremitting pain, pain medications such as tramadol or narcotics are indicated in the early stages of treatment to give relief until the above measures have time to become effective.

The Proprioceptive loss causes ataxia and in coordination, resulting in functional deficits. According to that the therapy should include techniques of sensory reintegration and repetitive exercises to redevelop coordination. These techniques will aid in developing motor engrams that are based on the altered sensory perception.

Usually to inpatients with GBS appears Dysautonomia. The patients have excessive sympathetic outflow and hypertension appears to have extreme sensitivity to vasoactive drugs. These patients are particularly likely to develop these episodes of hypotension or hypertension with suctioning. The treatment should be directed toward physical modalities such as compression tube, abdominal binders, and proper hydration [13].

Most of the patients usually recover, but sometimes the symptoms are so severe that it is very difficult to have any improvement and the disease leads to death.

## **2.8 Prognosis**

Regularly the recovery of the syndrome starts during the fourth week of the therapy, but always depends on the stage of the progress of the disease and how the patient reacts on it. Approximately the biggest percentage of the patients with GBS they recover fully within a few months to a year [9].

The main characteristic of GBS is that it develops spontaneously toward recovery from paralysis. It is require for the patient to have an extensive skilled medical and nursing care, [9] as well as a good psychological supportive from a specialist and from his/her family.

Some of the patients require an in-patient rehabilitation, in which a prior ventilator support predicts an extended length of stay on in-patient rehabilitation. Few more issues that affect the rehabilitation are dysautonomia, cranial nerve involvement, and a variety of medical

complications which are associated with the syndrome. A different pain syndrome is also common during the early stages of recovery [9].

To succeed an effective care for the Guillain-Barré patients it is necessary to be familiar with symptomatology, incidence therapy and complications of disease. Nevertheless the patients are a very heterogeneous group with regard to age, antecedent infections, immunological parameters, clinical manifestations and response to treatment [9].

## **3 Special Part**

### **3.1 Methodology**

My practice was done at Vojenská Nemocnice (UVN) in Prague for 2 weeks, from 11<sup>th</sup> to 22<sup>nd</sup> of February, 2010. My adviser was Mrs. Jitka Kobrová who gave me a list of patients from where I choose my bachelor patient. I got a patient with Guillain - Barré Syndrome and the sessions where during the first week twice and during the second week I saw him three times for one hour. Despite that I wanted to see my patient three more times because during the second week he got sick once and did not attend his session. Furthermore I wanted to work more with him, since he has an interesting situation and in order be able to see better results. The patient agreed with everything I needed so he was really helpful. An initial examination was done to determine patient's deformities.

The aids which were used in the examination were the hammer and goniometer. In therapeutic approach I worked with patient's balance, coordination, gait, body posture, breathing, and trigger points at his trapezius muscles and strengthening of body muscles especially the muscles at Lower Extremities. I worked with some PIR techniques according to Lewit and gently massage to release patient's trigger points at his trapezius muscles. Moreover I stimulated his nerves during gait and balance training. The therapy continued with PNF techniques for Upper and Lower extremities first and second diagonal of Flexion and Extension. Also the strengthening technique of PNF Hold-Relax-Active movement was included in the PNF therapy. Furthermore according to Friesen C. Severity of Yoga program – abdominal, diaphragmatic and thoracic the patient was trained to control his breathing wave.

I continued the therapy by training the patient's gait and balanced; according to the information given in Kendall. At the end of the session we worked at some isometric exercises with the use of a yellow Thera-band as suggested by Brügger's exercises and fit ball. The first part of the therapy was done at physiotherapist's room and the second part at the gym. The whole therapy was manual.

### **3.2 Anamnesis**

Examined person: G.F. (Male)

Date of birth: 1966

Diagnosis: Polyneuropathy Guillain - Barré Syndrome

Code: G61.0

#### Family Anamnesis:

- His father has diabetes mellitus 2<sup>nd</sup> type
- His mother is healthy
- His brother had Bells palsy in the one side of his face at the age of sixteen years old. At the present state his completely healthy
- His two sisters are healthy
- His three year old daughter is healthy
- His uncle had an infarct

#### Personal Anamnesis:

- In 1967 he had Glandular fever
- In 1981 he had for 2<sup>nd</sup> time Glandular fever
- In 1996 he had staphylococcus
- In July 5<sup>th</sup>, 2009 headaches started and keep for one month
- In August 8<sup>th</sup>, 2009 he hospitalize at Vojenská Nemocnice in Prague with the diagnosis of Guillain - Barré Syndrome

#### Main Complain:

- Between the period of March–May 2009, the patient suffered from headache at the forehead part of the brain

- In the middle of May he had a control at the Neurological department of Vojenská Nemocnice in Prague
- The doctors recommended him to have X-rays and MRI examination at his Cervical spine
- On May 25<sup>th</sup>, 2009 the patient was input at the Neurological department. He had tingling at his palms and soles
- Five days later he had a spinal tap twice, from where they diagnosed that he suffers from Guillain - Barré Syndrome
- On May 29<sup>th</sup>, the patient had plasmapheresis 4 times
- On June 9<sup>th</sup>, he was transferred to the intensive unit
- He was connected with a pulmotor
- For one week he was in artificial coma
- Approximately two weeks later they disconnected him. Now he is breathing by him self
- On July 2<sup>nd</sup>, they send him to the neurological intensive unit
- Three weeks later on July 27<sup>th</sup>, the tracheotomy closed
- Between August 12<sup>th</sup>-27<sup>th</sup>, of 2009 the patient took rehabilitation and physical therapy
- On August 27<sup>th</sup>–October 15<sup>th</sup>, he was at Jánské Lázně where he had the biggest part of his therapy
- On October 15<sup>th</sup>–29<sup>th</sup>, 2009 the patient went back at his home
- On October 29<sup>th</sup>–November 20<sup>th</sup>, he was hospitalize at the Faculty hospital Královské Vinohrady where he had rehabilitation therapy

#### Previous Operations:



- July 20<sup>th</sup> , 2009 he had tracheotomy
- July 27<sup>th</sup> , 2009 the doctors removed the tube from the patient's throat
- Social Anamnesis:
- He lives with his wife and their three years old daughter
- He lives in the second floor – 50 stairs, does not use the elevator. The patient is able to go upstairs and downstairs independently.

#### Occupation:

He works as a computer manager - sitting 40hrs/week (when he got ill he stopped working for six months and he started again 1<sup>st</sup> of January 2010)

#### Pharmacological Anamnesis:

The patient used to take medicines during the first months that he got ill. Now he does not use any medications.

#### Physical Activities:

- Golf
- Football

He used to play once per week. When he got ill, he stopped.

#### Abuses:

- He stopped smoking seven years ago
- Drinks occasionally

#### Allergy Anamnesis:

- None

#### Previous Physiotherapy:

On August 12<sup>th</sup>-27<sup>th</sup>, of 2009 the patient took rehabilitation and physical therapy. The therapy session included some active and passive exercises on the bed for his Upper and Lower extremities. The purpose of the exercises was to improve the mobility of the joints and to strengthen a bit the muscles of the extremities. The therapy was succeed, they observed an improvement at patient's Upper and Lower extremities.

On August 27<sup>th</sup>–October 15<sup>th</sup>, he was at Janské Lázně (Spa) where he had the biggest part of his therapy.

The therapy consisted logo therapy, since the patient had facial diparesis. The patient's left side is stronger than the right one. Also he had unsatisfactory muscle tension in the area of his labium and because of this he couldn't articulate well.

Moreover the therapy was involved by three phases:

➤ First phase:

Start's with Kinesiotherapy at the bed. It included exercises for movement and lifting up the pelvis. The therapy continued with training of changing position from lying to sitting in straight position without the help of aids, only by using his elbow joints. At the same time they were training his balance.

➤ Second phase:

In the second phase of the therapy, the therapists were concentrating on changing position from the bed to the wheelchair and from the wheelchair to the rest room or to the shower.

Simultaneously they were training his balance and stability by exercising him at the wall bars and on a gym ball with the use of aids such as overball or a wood stick. In the meantime they stopped training at the wall bars and they were succeeding to win his balance only by exercising on the gym ball. Furthermore they were concentrating at the training of dressing up and undressing, especially with his pant and socks, which were difficult for the patient.

➤ Third phase:

At the end of the session the therapists were concentrating to improve the posture of the patient. They accomplished something by exercising him at the wall bars and by relaxing exercises of the pelvis. Moreover they added to the program the training of patient's standing position with the help of the wall bars. The patient achieved this quickly. In addition they were training his gait on all fours on a mattress. He was able to crawl on all fours, without stopping for a distance of 3 meters.

At the final point they were exercising his Upper Extremities by the use of power ball.

- The therapy was really successful

On October 29<sup>th</sup>–November 20<sup>th</sup>, he was hospitalized at the Faculty hospital Královské Vinohrady where he had rehabilitation therapy. In the therapy were included training of walking and general exercises for his Upper and Lower extremities. The therapy was mostly for the Lower extremities since he found to have more weakness.

- The patient day by day got better.
- The therapy at the spas played a big role at patient's problem and there he had the biggest part of his improvement.

#### Medical Anamnesis:

- In the middle of May 2009 he had a control at the Neurological department of Vojenská Nemocnice (hospital ) in Prague
- The doctors recommended him to have X-rays and MRI examination at his Cervical spine
- On May 25<sup>th</sup>, 2009 the patient was input at the Neurological department. He had tingling at his palms and soles
- Five days later he had a spinal tap twice, from where they diagnosed that he suffers from Guillain - Barré Syndrome
- On May 29<sup>th</sup>, the patient had 4 times plasmapheresis

- On June 9<sup>th</sup>, they transferred him to the intensive unit
- He was connected with a pulmotor
- For one week he was in artificial coma
- Approximately two weeks later they disconnected him, now he breaths without the help of any aids
- On July 2<sup>nd</sup>, they send him to the neurological intensive unit

Doctor Documentation (December 14<sup>th</sup>, 2009):

- The patient was sent to the ambulatory rehabilitation after an acute inflammatory demyelinating polyneuropathy; Guillain - Barré Syndrome in May 5<sup>th</sup>, 2009.
- On August 8<sup>th</sup>, 2009 he was hospitalized in Vojenská Nemocnice for bed rehabilitation, where he stayed until August 26<sup>th</sup>. Then he went to Jánské Spa from August 27<sup>th</sup> – October 15<sup>th</sup>.
- On October 29<sup>th</sup>, he went to Faculty Hospital Královské Vinohrady until the November 20<sup>th</sup>.
- The patient had some paraparesis at his lower extremities and while he was standing he was unstable.
- He used forearm crutches and he had paresthesia and dysesthesia at his soles.
- His vision from close got worse.
- He had big damage at his motor system. It was more obvious at his lower extremities where are the total transfer blocks Peroneal and Tibial nerves bilaterally.
- At the right Upper Extremity there was a severe damage of the motor system at his Median and Ulnar nerves. The damage was motor-sensory, but not peripheral.
- According the clinical diagnose he had peripheral inflammation polyneuropathy in advanced phase. It was a finding of blockage in nerve impulses.

- He had an EMG control after his therapy at Spa, which was positive
- He had unstable gait
- He had a wide base and while he was standing he was slightly unstable
- His muscle power at his Upper Extremities was symmetrical
- The Lower Extremities are not so strong
- Dorsi Flexion and Plantar flexion were slightly weak
- Dysesthesia at his soles
- Hyperesthesia at his toes
- It was suggested for patient's therapy correction of his muscle power, Kinesiotherapy and improvement of his gait and stability.

#### Indication of Rehabilitation:

According to doctor's suggestions the therapy was based mostly at patient's balance, gait, and muscle straightening especially at his lower extremities.

#### **Present state:**

Weight: 90 kg

Height: 1,73cm

BMI: 30.1

Blood pressure: 100/70

The patient suffers from demyelinating polyneuropathy; Guillain - Barré Syndrome.

His vision from near is not so good. He is not very stable and while he is walking he uses sticks for his supporting, and to keep his body in straight position; especially during long distance walking. Moreover the patient is standing in a wide base. According doctor's documentation he has full blocks of peroneal and tibial nerves bilaterally at his left Lower

Extremity; and difficult defect of motoric functions of median and ulnar nerve at his right Upper Extremity.

According to Kendall patient's muscle strength at his arms is symmetric. However the muscle power at his lower extremities is not symmetric, since the left leg is weaker. Furthermore according to Neurological examination he has Dysesthesia at his soles and Hyperesthesia at his toes.

Based on subjective description when he is walking for long time, standing or exercising he feels stitches at his fingers and toes. Moreover he does not feel stable while he is walking, so he uses two walking sticks, to feel safer and to keep his body posture in upright position. The patient also mentioned that he feels weakness at his Lower extremities especially the left one.

**Differential Consideration [3]:**

- Autoimmune response to a previous respiratory infection
- Influenza
- Immunization or surgery
- Vital infections
- Epstein – Barr syndrome
- Cytomegalovirus
- Bacterial infections
- Surgery
- Vaccination

### 3.3 Initial Kinesiology Examination:

The examination took place at the physiotherapy department of Vojenská Nemocnice in Prague, on January 13<sup>th</sup>, 2010.

#### 3.3.1 Posture Evaluation according to Kendall [8]

##### Inspection:

##### Posterior View:

- Slight unstable stand
- Wide base
- More weight on left heel
- Heels are physiological
- Left knee is slightly extended
- Pelvis – level of left iliac crest is higher
- Pelvis – level of left posterior superior iliac spine is higher
- Scapulae in neutral position
- Left shoulder is higher
- Rotation of the head to the left side



Photo 1 – Initial  
Kinesiological examination,

Side views:

Left Side	Right Side
External Rotation of foot	More External Rotation of foot
Semi-flex knee joints	Right knee joint is more extended
Slight anterior tilt of the pelvis	Slight anterior tilt of the pelvis
Lumbar spine – slight lordosis	Lumbar spine – slight lordosis
Thoracic spine – slight kyphosis	Thoracic spine – slight kyphosis
Cervical spine – slight lordosis	Cervical spine – slight lordosis
Shoulders - forward	Shoulders – forward
Head – slightly tilted forward	Head – slightly tilted forward

Table 1 – Posture evaluation between left and right side, side view



Photo 2 - Initial  
Kinesiological examination



Photo 3 - Initial  
Kinesiological examination



### Anterior view:

- Slight unstable stand
- Wide base
- External rotation of feet
- Patellae are in the same high
- Pelvis - anterior superior iliac spines are equal
- Right Thoraco-Lumbar triangle is bigger
- Nipples are in the same level
- Left shoulder joint is higher
- Rotation of the head to the left side



Photo 4 - Initial Kinesiological examination, anterior view

### Breathing Pattern:

The patient has abdominal breathing pattern. While he is walking is not so obvious.

### Standing on two scales:

Left lower extremity → 50kg

Right lower extremity → 40kg

### Gait Evaluation:

The Gait examination was divided into four parts.

### First Part - Normal walking:

- Two points walking on feet
- Wobble walking
- Left foot – bigger step
- External Rotation of feet
- Trunk rotation is slightly visible
- A bit tension in upper extremities, arms are not relax
- Head facing forward

### Second Part - Walk on toes:

- The patient wasn't very stable, despite that he was able to walk on his toes

### Third Part - Walk on heels:

- It was painful for him. He couldn't apply it

### Forth Part - Squat walking:

- The patient could not apply it

## **3.3.2 EXAMINATION OF BASIC MOVEMENT PATTERNS** according to Janda

Right Side	Left Side
Gluteus Maximus	Biceps Femoris
Biceps Femoris	Contra lateral Erector Spinae
Contra lateral Erector Spinae	Gluteus Maximus

Table 2 – Description of muscle timing on right and left side during hip Extension

Right Side	Left Side
Gluteus Medius	Gluteus Medius
Gluteus Minimus	Gluteus Minimus
Tensor Fasciae Latae	Tensor Fasciae Latae
Quadratus Lumborum	Quadratus Lumborum
Iliopsoas & Rectus Femoris	Iliopsoas & Rectus Femoris
Abductors	Abductors
Back muscles	Back muscles

Table 3 – Description of muscle timing on right and left side during hip ABD

Deep neck Flexors
Superficial Flexors

Table 4 – Description of muscle timing during neck flexion

Hip Flexors - Iliopsoas
Abdominals
Back muscles

Table 5 – Description of muscle timing during trunk flexion

### 3.3.3 Evaluation of Range of Motion (all joints)

ROM according to Kendall, in all joints [8]:

The measurements were done according to ISOM method

Range of Motion Right Side	Joints	Range of Motion Left Side
S 10°-0°- 125° F 40°- 0°- 15° Rs 40° - 0° - 25°	Hip joint	S 10° - 0° - 125° F 40° - 0° - 15° Rs 40°- 0° - 25°
S 0°- 0° - 140°	Knee joint	S 0°- 0° - 140°
S 10° - 0° - 45° Rs 25° - 0° - 30°	Ankle joint	S 10° - 0° - 45° Rs 25° - 0° - 25°

Table 6 –Evaluation of ROM at L.E. during active movements , on left and right side

Range of Motion Right Side	Joints	Range of Motion Left Side
S 15°-0°- 125° F 45°- 0°- 20° Rs 45° - 0° - 30°	Hip joint	S 15° - 0° - 125° F 45° - 0° - 20° Rs 45°- 0° - 30°
S 0°- 0° - 140°	Knee joint	S 0°- 0° - 140°
S 10° - 0° - 45° Rs 25° - 0° - 30°	Ankle joint	S 10° - 0° - 45° Rs 25° - 0° - 30°

Table 7 –Evaluation of ROM at L.E. during passive movements on left and right side

Range of Motion		Joints		Range of Motion
Right Side				Right Side
S 45°- 0°- 180°		Shoulder joint		S 45°- 0°- 180°
F 180° - 0° - 0°				F 180° - 0° - 0°
Rs 90° - 0°- 70°				Rs 90° - 0°- 70°
S 0°- 0°-145°		Elbow joint		S 0°- 0°-145°
S 90°- 0°- 90°		Forearm		S 90°- 0°- 90°
S 80°- 0°- 70°		Wrist joint		S 80°- 0°- 70°
Rs 35° - 0° - 20°				Rs 35° - 0° - 20°

Table 8 – Evaluation of ROM in U.E. during active movement, on right and left side

Range of Motion		Joints		Range of Motion
Right Side				Right Side
S 45°- 0°- 180°		Shoulder joint		S 45°- 0°- 180°
F 180° - 0° - 0°				F 180° - 0° - 0°
Rs 90° - 0°- 70°				Rs 90° - 0°- 70°
S 0°- 0°-145°		Elbow joint		S 0°- 0°-145°
S 90°- 0°- 90°		Forearm		S 90°- 0°- 90°
S 80°- 0°- 70°		Wrist joint		S 80°- 0°- 70°
Rs 35° - 0° - 20°				Rs 35° - 0° - 20°

Table 9 – Evaluation of ROM in U.E. passive movements, on right and left side

### **3.3.4 Examination of shortened muscles:**

According to Kendall we provide muscle length tests [8]

The results are the same on both sides of the body

- M. Triceps surae – gastrocnemius (10)
- Soleus (> 10)
- Hamstrings – (< 80)
- Hip flexors – iliopsoas (0)
- Rectus femoris ( 80)
- Sartorius (hip ABD, F, ER, knee F)
- Tensor fasciae latae (hip ABD, F, IR, knee E)
- M. Rectus abdominis
- Hip adductors – one joint ( >45) – two joint flexors (45)
- Knee flexors – one joint – two joint flexors (80 straight knee – 90 bend knee)
- Back muscles – bend forward in sitting position with extended knees (10cm), with flexed knees (<10cm)
- M. Quadratus lumborum – trunk lateral flexion
- M. Pectoralis major (> 0 and soft barrier)
- M. Pectoralis minor
- Cervical lateral flexion (45)
- Levator scapulae (F, R, LF – depression of scapula)
- M. Sternocleidomastoideus (E, R, LF)
- Scalene muscles (R 45, E)

\*Hamstring muscles are shorten than the rest muscles

### 3.3.5 Muscle strength test – according to Kendall [8]

MUSCLES	INNERVATION	FUNCTION	GRADE EVALUATION FOR RIGHT SIDE	GRADE EVALUATION FOR LEFT SIDE
Peroneus Longus	Superficial Peroneal n.	Pronation, Plantar Flexion and Abduction of the leg	4	3
Peroneus Brevis	Superficial Peroneal n.	Plantar Flexion, Eversion	4	3
Tibialis Anterior	Deep Peroneal n.	Dorsiflexion, Inversion	4	3
Tibialis Posterior	Tibial n.	Plantar Flexion, Inversion	4	3
Iliopsoas	Lumbar Plexus, Femoral n.	Flexion, Rotation of thigh medially, Flexion of vertebral column	4	3
Rectus Abdominis	Intercostal nn. VI-VII	Compresses abdomen and flexes vertebral column	3 slight lordotic posture	3 slight lordotic posture
Transversus Abdominis	Intercostal nn. VII-XII, Iliohypogastric n., Genitofemoral n.	Compresses abdomen	3	3
External oblique lateral fibers	Intercostale nn. IV-XII	Bend vertebral column laterally, rotation of vertebral column	3	3
External oblique anterior fibers	Intercostale nn. IV-XII	Bend vertebral column laterally, rotation of vertebral column	3	3

Internal Obliques	Intercostale nn. VIII-XII	Flatten the abdominal wall and compress the abdominal viscera	3	3
Tensor Fasciae latae	Gluteus Superior n.	Abducts, Flexes, Internally rotates the hip and extends the knee	4	4
Sartorius	Femoral n.	Flexion of knee, flexes hip and rotate femur laterally	4	4
Pectoralis Major (Upper & Lower)	Pectoral nn., Thoracic anterior nn.	Flexes, adducts, rotates arm medially	5	5
Pectoralis Minor	Pectoral nn.	Lowers shoulder blade	5	5
Medial Rotators of Shoulder	Peripheral n.	Medial rotation of shoulder blade	5	5
Serratus Anterior	Thoracic longus n.	Stabilises scapula when hand exerts pressure on an object	4	4
Biceps Brachii	Musculocutaneus n.	Flexion and supination of forearm	5	5
Brachioradialis	Radial n.	Flexes, semi-supinate and semi-pronate the forearm	5	5
Supinator	Radial n.	Supinates forearm and hand	5	5
Triceps Brachii and Anconeus	Radial n.	Extends forearm and arm	5	5
Pronator Teres	Median n.	Pronates and flexes forearm	5	5



Pronator Quadratus	Median n.	Pronates the forearm and hand	5	5
Flexor Carpi Radialis	Median n.	Flexion of the hand	5	5
Flexor Carpi Ulnaris	Ulnar n.	Flexion of the hand	5	5
Extensor Carpi Radialis Longus & Brevis	Radial n.	Extension of the hand	5	5
Extensor Carpi Ulnaris	Radial n.	Extension of the hand	5	5
Posterolateral Neck Extensors	Cervical plexus	Posterolateral extension of neck	4	4
Upper Trapezius	Accessory n.	Elevate clavicle, adducts, elevates and rotates scapula outwards, and extends head	5	5
Back Extensors	Brachial plexus	Extension of back	4 slight kyphosis on thoracic spine	4 slight kyphosis on thoracic spine
Deltoid Anterior	Axillary n.	Abduct, flex, extend, medially and laterally rotates arm	4	4
Neck Flexors Anterior	Cervical plexus	Flexion of the head	4	4
Anterolateral Neck Flexors	Cervical plexus	Anterolateral flexion of the neck	4	4
Quadratus Lumborum	Subcostal n., fibers of Lumbar plexus	Side flexion	4	4

Latissimus dorsi	Thoracodorsal n.	Extends, Adducts and rotates arm medially. Moves arm downwards and upwards	5	5
Romboids & Levator Scapulae	Dorsalis scapulae n.	Adduct scapula and raises shoulder blade	4	4
Middle Trapezius	Accessory n.	Lift clavicle, adduct, elevate and rotates scapula outward. Extend head	4	4
Lower Trapezius	Accessory n.	Lift clavicle, adduct, elevate and rotates scapula outward. Extend head	4	4
Teres Major	Suprascapular n.	Extends arm, assists in adduction and medial rotation of arm	4	4
Subscapularis	Subscapular n.	Medial rotation of shoulder joint	4	4
Gluteus Medius	Gluteus superior n.	Adduction of hip joint	4	3
Gluteus Minimus	Gluteus superior n.	Adduction of hip joint	4	3
Hip Adductors	Obturator nerve	Adduction of hip joint	3	3
Soleus	Tibial n.	Plantar flexes foot	4	4
Gluteus Maximus	Gluteus inferior n.	Extends and rotates thigh laterally	3	3
Quadriceps Femoris	Lumbar and Sacral plexus	Extension of hip	4	4

Gastrocnemius & Plantaris	Tibial n.	Plantar flexes foot and flexes knee	4	4
Ankle Plantar Flexors	Tibial n.	Ankle plantar flexion	4	3
Shoulder Lateral Rotators	Brachial plexus	Lateral rotation of shoulder	4	4
Teres Minor	Axillary n., Suprascapularis n.	Lateral rotation of shoulder joint	4	4
Shoulder Medial Rotators	Brachial plexus, C6	Medial rotation of shoulder joint	4	4
Popliteus	Tibial n.	Medial rotation of tibia on the femur and flexion of knee joint	4	4
Semitendinosus & Semimembranosus	Tibial n.	Flexes leg and extends thigh	4	4
Biceps Femoris	Tibial n., Peroneal n.	Flexes leg and extends thigh	4	4

Table 10 - Muscle strength evaluation, on right and left side

### 3.3.6 Basic Neurological Examination:

- Examination of movement patterns (Gait analysis, breathing, Prof. Janda test) – physiological. The examinations are written analytic on the above examinations
- Babinsky test → Plantar response L4-5 to S1-2 → On palms is negative, on right sole slight dorsiflexion of the great toe, and on the left sole biggest dorsi-flexion of the great toe. Left leg is more sensitive

REFLEXES	Main Spinal Nerve Roots	Grades on Right Side	Grades on Left Side
Biceps Brachii	C5	2*	2*
Brachioradialis	C6	2*	2*
Triceps Brachii	C7	2*	2*
Flexors of hand	C8	2*	2*
Patellar	L2-L4	0**	0**

Table 11 - Scale of Deep tendon Reflexes

\*Very slight movement, without facilitation

\*\* No movement

- Reflexes – Are pathological on Lower Extremities

- Sensation test → Deep and Superficial

#### Deep Sensation

Both examinations were performed in lying position the first at supine position and the second at prone position

Movement sensation on toes → The patient was sometimes able to say when the movement started, ended and at which toe it was applied, but sometimes he was not able to

describe the above movements. At the left L.E. the problem of recognizing the movement and the touch was bigger.

### Superficial Sensation

- Sensation on soles → The patient was able to feel the touch at his soles. During the examination in some cases he was really sensitive. The sensitivity is increased at the left sole. The areas he is more sensitive are C4 and L5 dermatomes
- Sensation on arms and back, by Graphesthesia. He was able to understand the numbers we were drawing on his body and the touch
- During the sensation tests the subject cooperated with the therapist. He mentioned that during the test of sensation on his soles he felt a bit unpleasant and especially during the application at his left sole.
- Metric distance function – physiological
- Tension tests, Lasegue sign – physiological
- Examination of extremities (position, patterns, atrophies, active mobility, passive mobility, resistance examination) – Good. The results are written analytic on the above examinations

#	Name	Sensory or Motor		
		Origin		Evaluation
I.	Olfactory	Sensory		Good
II.	Optic	Sensory		Good
III.	Oculomotor	Motor	Midbrain	Good
IV.	Trochlear	Motor	Midbrain	Good
V.	Trigeminal	Both	Pons	Skin - good, Corneal reflex - good, Tendon reflex - good

VI.	Abducens	Motor	Posterior Margin of Pons	Good
VII.	Facial	Both	Pons	Good
VIII.	Vestibulocochlear	Sensory	Lateral to N. VII.	Good
IX.	Glossopharyngeal	Both	Medulla	Good
X.	Vagus	Both	Postero-lateral sulcus of Medulla	Good
XI.	Accessory	Motor	Cranial and Spinal roots	Good
XII.	Hypoglossal	Motor	Medulla	Good

Table 12 - Cranial nerve reflexes

### 3.3.7 Special tests - Balance tests:

#### ➤ Trendelenburg test:

I asked from my patient to provide this test on both sides. I observed that patient's left hip drops to the left side. According to this test, left gluteus medius is weak; and the test is positive.

#### ➤ Rhomberg test

Rhomberg I – no visible movement

Rhomberg II– slight play of muscles on leg and small swaying movement of body

Rhomberg III –instability: had to step forward and open eyes to stabilize self– pathological

Walk on line → He loses his balance, especially with close eyes.

Vele's test → Negative

Standing on one leg for eight seconds → Right leg – a bit unstable, Left leg – the instability is increasing. The problem on both extremities is located mostly at his ankles

### **3.3.8 Palpation:**

I provided palpation to upper trapezius muscles on both sides; because the patient was complain for a pain. I observed that he has some trigger points on both sides.

### **3.3.9 Subjective response:**

Following the examination the patient felt very tired. Despite this he was very cooperative with me and he was really helpful.

### **3.3.10 Conclusion of examination:**

According to the initial kinesiological examination the main problems of patient with the diagnosis of Guillain-Barré Syndrome are with his stability, walking and weakness at his lower extremities more on the left one. Moreover he has some pain at his upper trapezius muscles were I found some trigger points. Furthermore patient has dysesthesia at his soles and hyperesthesia at his toes. In addition the problem includes his breathing and bad posture.

### **3.3.11 Goals of the Therapeutic Unit:**

- Improving patient's stability
- Improve his walking
- Strengthen his lower extremities – symmetrical power
- Release the trigger points at his upper trapezius muscles
- Improve the breathing wave
- Improve patient's posture

### **3.3.12 Therapy proposal and Procedure:**

- Proprioceptive exercises for better stability and for improvement of patient's deep sensation. The therapy consists of some balance exercises such as standing on balance board, standing on one leg, jumping on the trampoline first with two legs and then with one leg, training of three steps walking, small foot and by stimulation of the nerves in supine lying position with the use of a massage ball
- Training on three point's step walking to improve his gait and his stability by Proprioceptive exercises
- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension, Hold-Relax-Active movement on Upper and Lower extremities according to Kabat for: Hip ADD on both sides → 1<sup>st</sup> Diagonal of Flexion, Gluteus maximus on both sides → 2<sup>nd</sup> Diagonal Extension, Gluteus medius & minimus on left side → 1<sup>st</sup> Diagonal Extension, Tibialis posterior on left side → 2<sup>nd</sup> Diagonal Extension, Tibialis anterior on left side → 1<sup>st</sup> Diagonal Flexion, Peroneus brevis on both sides → 2<sup>nd</sup> diagonal Flexion, Peroneus longus on both sides → 1<sup>st</sup> Diagonal Extension. The therapy is to increase the muscle power. We work more on his Lower extremities to succeed a symmetrical power, since the left lower extremity is weaker than the right.
- PIR techniques for upper trapezius muscles according to Lewit and some soft tissue techniques to relax them, because are overload [11]
- Exercises for breathing wave – Upper thoracic, diaphragmatic and abdominal breathing. By improving his breathing pattern we improve his posture as well
- Brügger's postural exercises for Flexion and Extension of back by the use of a yellow Thera-band [19]. The exercises are applied for strengthening of back muscles and to improve his posture
- Therapeutic pool exercises which may indicate to initiate movement without the effects of gravity and to improve patients balance



### **3.4 Short term and Long rehabilitation plan:**

#### Short term rehabilitation plan:

- Proprioceptive exercises for stability
- Training on three steps walking to improve his gait
- PNF techniques, according to Kabat, 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension with Hold-Relax-Active movement on Upper and Lower extremities to increase the power. We worked more on his Lower extremities to succeed a symmetrical power. The muscles which are trained most are: Hip ADD on both sides → 1<sup>st</sup> Diagonal of Flexion, Gluteus maximus on both sides → 2<sup>nd</sup> Diagonal Extension, Gluteus medius & minimus on left side → 1<sup>st</sup> Diagonal Extension, Tibialis posterior on left side → 2<sup>nd</sup> Diagonal Extension, Tibialis anterior on left side → 1<sup>st</sup> Diagonal Flexion, Peroneus brevis on both sides → 2<sup>nd</sup> diagonal Flexion, Peroneus longus on both sides → 1<sup>st</sup> Diagonal Extension.
- Brügger's postural exercises for flexion and extension of the back, by the use of a yellow Thera-band to improve patients posture and strengthen his back muscles [18]
- PIR according to Lewit and some soft tissue techniques for upper trapezius muscles to relax them, because are overload [ 11]

#### Long term rehabilitation plan:

- I can only recommend a similar program of therapy for the rehabilitation of this diagnosis, since the subject get's better after every session.

### **3.5 Therapy progress:**

The therapy took place at the physiotherapy department of Vojenská Nemocnice (UVN) in Prague for 2 weeks, from 11<sup>th</sup> to 22<sup>nd</sup> of February, 2010.

During the first week I worked with the patient twice for one hour. Also during the second week I saw him three times for one hour. Despite that I wanted to see my patient three more times because during the second week he got sick once and did not attend one session.

The patient was coming to the hospital every Tuesday, Wednesday and Friday from 15:00-16:00 p.m. The therapy included seven sessions.

First session – Wednesday 13<sup>th</sup> of January, 2010

15:00-16:00 p.m.

\*S: The patient mentioned that sometimes, when he is in the same position for a long time he feels tingling at his lower extremities. The tingling starts from the upper part of the leg and goes to the toes. Moreover he mentions that he is not able to sit on the floor and then stand up. He was afraid to apply it.

\*O: According to the initial kinesiological examination I observed that the patient's main problems are with his stability, dysesthesia at his soles and hyperesthesia at his toes, gait, weakness at his lower extremities, more on the left one and with some trigger points at his trapezius muscles which may be caused by his bad posture or breathing pattern.

\*P: Goals of today's Therapeutic Unit:

- Release the trigger points by soft tissue techniques and PIR on his Upper trapezius muscles.
- Work at patient breathing wave
- Straightening his body muscles back, gluteal and legs muscles
- Improve his walking, stability and posture

Procedure:

- PIR for upper trapezius muscles and soft tissue techniques to relax them, because are overload. The therapy last 10 minutes
- Exercises for breathing wave – Upper thoracic, diaphragmatic and abdominal to improve his breathing. By improving his breathing pattern we improve his posture as well. First I asked from the patient to be in supine position and place one hand at his abdomen and the other hand at his chest, he inspired and during expired he changed the position of his hands. At the second phase I asked from the patient to place both his hands at his lower ribs and breathe below his hands. Each exercise kept two minutes. The patient was concentrating at his breathing wave. The breathing exercises kept 5 minutes

- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension by strengthening technique of PNF Hold-Relax-Active movement on Upper and Lower extremities to increase the power. The muscles which need more strengthening are the follow: Hip ADD on both sides → 1<sup>st</sup> Diagonal of Flexion, Gluteus maximus on both sides → 2<sup>nd</sup> Diagonal Extension, Gluteus medius & minimus on left side → 1<sup>st</sup> Diagonal Extension, Tibialis posterior on left side → 2<sup>nd</sup> Diagonal Extension, Tibialis anterior on left side → 1<sup>st</sup> Diagonal Flexion, Peroneus brevis on both sides → 2<sup>nd</sup> diagonal Flexion, Peroneus longus on both sides → 1<sup>st</sup> Diagonal Extension. We work more on his Lower extremities to succeed a symmetrical power. PNF exercises kept 15 minutes.
- Brügger's postural exercises for flexion and extension of his back, by the use of a yellow Thera-band to improve patient's posture and strengthen his back muscles. The patient executed the exercises in sitting position, 2 sets of 10 times. *Brügger's exercises are according Doc. Pavlu's book, page 50 (exercise 30a, 30b) and page 54 (exercise 34a, 34b) [18].* The patient was training for 10 minutes
- Proprioceptive exercises for stability [19]. The groups of exercises which I used are the follow: walk on line, stand on bosu for 10 seconds, and jump on trampoline first with both legs and then by one leg. Then the subject is standing on the floor first on one leg for eight seconds and then to the other. The whole session lasted 15 minutes
- Training on three points pressure walking to improve his gait for 5 minutes

#### Discharge Summary:

S: According to the patient he said that he was feeling a bit tired, but in a good way as he used to feel while he was working out. Also he said that he feels more relief at his upper trapezius after the PIR and soft tissue techniques

O: From my point of view I observed that the patient has good will, and he wants to work really hard to improve. He was able to cooperate with me and apply all the exercises. In contrast he faced some difficulties with the breathing exercises; he couldn't find the correct rhythm and coordination of his breathing wave. Moreover during the exercise that he had to

stand on one leg on the floor he was losing his balance, especially when he had to stand on his left leg. During palpation I observed that the PIR and soft tissue techniques were effective.

Self therapy:

Since it was the first treatment I didn't give to the patient any self therapy. I recommended to him, to get rest, to be able to exercise with me on Friday.

Second session – Friday 15<sup>th</sup> of January, 2010

15:00-16:00 p.m.

S: The patient came to the physiotherapy department full of energy and ready for the second session of his therapy with me.

O: Based on Wednesday's therapy I will continue with the same therapy, since the patient likes it and he didn't complain for any disturbances.

A: Since the first therapy was good for my patient, in the today's session I will continue with more dynamic exercises.

P: Goals of today's Therapeutic Unit:

- The Therapeutic Unit it will be the same as in first session, but with more dynamic exercises

Procedure:

- PIR for upper trapezius muscles and some soft tissue techniques. See the explanation in session one
- Exercises for breathing wave – See the explanation in session one
- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension by strengthening technique of PNF Hold-Relax-Active movement on Upper and Lower extremities – See the explanation on session one
- The subject takes place in supine position on the floor. He provides sit-ups for rectus abdominis and oblique muscles, 3 sets of 10 times for all abdominal muscles. Then he continues with exercises of gluteal muscles in prone position 2 sets of 10 times. The patient lies on his stomach. He has the one leg extended and the other flexed at his knee joint. He elevates the flex lower extremity and at the same time he contracts his gluteal muscles. Then he does the same with the opposite extremity. At the time that patient had to go in sitting position and then in standing position from the floor I taught him the analgetic position in which the subject lay first at his side, with the lower leg stretch and

with the leg that he is not laying on, semi-flex. Then with the help of his hand he helps his body and he push to stand up. This technique is more helpful for him and he does not overload his spine.

- At the end we worked on sitting position with his back muscles by Brügger's postural exercises with the use of a yellow Thera-band, 2 sets of 10 times. He executed the exercises for 20 minutes
- Proprioceptive exercises for stability. See the explanation on session one
- Training on three point pressure walking – See the explanation on session one

#### Discharge Summary:

S: The patient is feeling his muscles while they work out.

O: He was able to cooperate with me and apply all the exercises. At the end of the exercises on the floor the patient had difficulty to stand up, because of the weakness at his lower extremities and his balance. I was helping him a lot to be able to go into standing position. Moreover he faced difficulty with the breathing exercises; he still couldn't find the correct rhythm and coordination of his breathing wave. Furthermore during the exercise that he had to stand in one leg on the floor he was losing his balance, especially when he had to stand on his left leg. The subject feels more relief at his upper trapezius after the PIR and soft tissue techniques, I am also able to see and feel that therapy by therapy the trigger points are more release.

#### Self therapy:

I recommended to him, to take some rest for today, and he can go for a walk on Saturday, since he used to walk for one-two miles every day. During his walking is good to use his walking sticks to improve his posture and his stability, moreover I recommend him to be accompany with another person in case he will feel tired or something will go wrong.

Third session – Tuesday 19<sup>th</sup> of January, 2010

15:00-16:00 p.m.

S: The patient still has the same energy as he had at the two first therapies

O: Based on the other two therapies I will continue with the same goals of therapy, except the correction of his breathing wave, since during the previous sessions he was not able to follow the exercise. I will concentrate a bit more at patient's posture, balance and strengthening exercises, since are the most important effects for his therapy.

A: Since the first therapy was good for my patient, in the today's session I will continue with the dynamic group of exercises.

P: Goals of today's Therapeutic Unit:

- Release the trigger points at his upper trapezius muscles by soft tissue techniques
- Strengthen his lower extremities – symmetrical power
- Straightening his body muscles, especially the abdominal, back, gluteal and legs muscles
- Improve his walking, stability, posture, breathing and stretching his hamstring muscles.

Procedure:

- PIR for upper trapezius muscles and some soft tissue techniques – See the explanation on session one
- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension by strengthening technique of PNF Hold-Relax-Active movement on Upper and Lower extremities – See the explanation in session one
- The subject takes place in supine position on the floor – See the explanation in session two
- At the end we worked on sitting position with his back muscles by Brügger's postural exercises with the use of a yellow Thera-band – See the explanation in session two



- Proprioceptive exercises for stability - See the explanation in session one
- Yoga exercises for patient's stability, strengthening and breathing. Furthermore I used the Yoga exercises to stretch patient's muscles especially his hamstrings which are shorten than the rest muscles. These exercises took place in sitting and standing position. The Yoga exercises are according the book of Bob [13]. The patient was training with Yoga exercises for ten minutes
- Training on three point pressure walking, walking on toes, and on line – See the explanation in session one.

#### Discharge Summary:

S: The patient is feeling his muscles while they work out. He felt some slight pain at his hamstring muscles during the stretching.

O: He was able to cooperate with me and apply all the exercises. At today's therapy he was able to go in standing position easier than the first time. I was still helping him by supporting him but not so much. Moreover his walking and stability were slightly improved. Also I observed that the trigger points at patient's trapezius muscles after the third therapy were release.

#### Self therapy:

It's recommended to the patient to take the day off and relax. I didn't want him to exercise at his home, and overload his muscles or get tired, since tomorrow we will continue with the therapy together.

Fourth session – Wednesday 20<sup>th</sup> of January, 2010

15:00-16:00 p.m.

S: The patient was a bit tired.

O: Since my patient was feeling a bit tired I have decided for this session to work in lighter program.

A: I will follow the same goals of therapy, the same exercises but with fewer sets

P: Goals of today's Therapeutic Unit:

- Strengthen his lower extremities – symmetrical power
- Straightening his body muscles, especially the abdominal, back, gluteal and legs muscles
- Improve his walking, stability, posture, breathing and stretching his hamstring muscles.

Procedure:

- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension by strengthening technique of PNF Hold-Relax-Active movement on Upper and Lower extremities – See explanation in session one
- The subject takes place in supine position on the floor – See explanation in session two
- At the end we worked on sitting position with his back muscles by Brügger's postural exercises with the use of a yellow Thera-band - See explanation in session two
- Proprioceptive exercises for stability – See explanation in session one
- Yoga exercises for patient's stability, strengthening and breathing – See explanation in session three
- Training on three point pressure walking – See explanation in session one

Discharge Summary:

S: The patient is feeling his muscles while they work out. He still feels some slight pain at his hamstring muscles during the stretching.

O: He was able to cooperate with me and apply all the exercises. In the exercise with changing position was able to go in standing position much easier than the other times. I was still helping him by supporting him slightly. During the whole therapy I was asking him if he feels more tired or weird. The patient mentions that he was able to apply everything and complete his therapy. He didn't feel very tired just normally tired.

Self therapy:

Since the subject was a bit tired it was better to not apply any exercise at home. In case that he was feeling well the day after I recommended him to apply some stretching exercises and training a bit his gait by the three points step, and by the help of his supporting sticks. Despite this I told him to not go for a long distance walking to not get tired.

Fifth session – Friday 22nd of January, 2010

15:00-16:00 p.m.

S: The patient didn't come to the therapy, since in the morning he went for a walk of 2 miles and he got tired. He said that he was feeling numbness at his Lower Extremities which was started from quadriceps muscles and continues till his toes.

O: I recommended him to stay at the bed for a while and take some rest

Sixth session – Tuesday 26th of January, 2010

15:00-16:00 p.m.

S: The patient was feeling good; he got rest during the weekend and now is able to work with me

O: I observed that the patient is strong enough and ready to exercise.

A: Based on patient's strength and improvement I will continue with the same goals and therapy

P: Goals of today's Therapeutic Unit:

- Strengthen his lower extremities – symmetrical power
- Straightening his body muscles, especially the abdominal, back, gluteal and legs muscles
- Improve his walking, stability, posture and breathing

Procedure:

- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension by strengthening technique of PNF Hold-Relax-Active movement on Upper and Lower extremities – See explanation in session one
- The subject takes place in supine position on the floor – See explanation in session two
- At the end we worked on sitting position at flexion and extension movements of his back muscles by Brügger's postural exercises with the use of a yellow Thera-band – See explanation in session two
- Proprioceptive exercises for stability - See explanation in session one
- Yoga exercises for patient's stability, strengthening and breathing – See explanation in session three
- Training on three point pressure walking – See explanation in session one

Discharge Summary:

S: The patient is feeling his muscles while they work out.

O: He was able to cooperate with me and apply all the exercises. At today's therapy he was able to stand up from the floor by himself, without my supporting or help. Moreover his breathing improved. Furthermore during the exercise that he had to stand in one leg on the floor, especially while he was standing on his left leg now he is able to apply it without having such a big misbalance.

Self therapy:

For the same day the patient have been asked to relax, since the day after we had the next therapy

Seventh session – Wednesday 27th of January, 2010

15:00-16:00 p.m.

S: The patient was feeling well

O: Therapy by therapy the patient is getting improved.

A: Based on patient's improvement I will continue with the same goals and therapy as in the above sessions

P: Goals of today's Therapeutic Unit:

- Improve the breathing wave
- Strengthen his lower extremities – symmetrical power
- Straightening his body muscles, especially the abdominal, back, gluteal and legs muscles
- Improve his walking, stability and posture

Procedure:

- Exercises for breathing wave – Upper thoracic, diaphragmatic and abdominal – See explanation in session one
- PNF techniques 1<sup>st</sup> and 2<sup>nd</sup> Diagonal of Flexion and Extension by strengthening technique of PNF Hold-Relax-Active movement on Upper and Lower extremities - See explanation in session one
- The subject takes place in supine position on the floor – See explanation in session two
- At the end we worked on sitting position on flexion and extension of his back muscles by Brügger's postural exercises with the use of a yellow Thera-band - See explanation in session two
- Proprioceptive exercises for stability – See explanation in session one
- Training on three point pressure walking - See explanation in session one

Discharge Summary:

S: The patient is feeling his muscles while they work out.

O: He cooperated with me and applied all the exercises. At today's therapy he got up from the floor by himself, without my support or help. The patient can now breathe better than before. Furthermore, his balanced improved, and this can be seen clearly when he is doing the exercise in where he has to stand only with the use of one leg. This improvement is more obvious when he is using his left leg for support.

Self therapy:

When the therapy of this day completed I asked from the patient to relax as the next day we were going to work on the same therapy.



### **3.6 Final kinesiological Examination:**

The final kinesiological Examination took place on Friday 29<sup>th</sup> of January, 2010 15:00-16:00 p.m.

S: The patient was feeling well and he was satisfied with the therapy, since the results were good, and he saw an improvement

#### **3.6.1 Standing Evaluation according to Kendall Inspection:**

Posterior View: (See photo number two in supplement)

- The stand is more stable
- Smaller base
- The weight is shifted equally
- Heels are physiological
- Left knee is slightly extended
- Pelvis – level of left iliac crest is slightly higher
- Pelvis – level of left posterior superior iliac spine is slightly higher
- Scapulae in neutral position
- Left shoulder is slightly higher
- Head in neutral position

Side views: (Photos number four and six)

Left Side	Right Side
Not so big External Rotation of foot	More External Rotation of foot but not as before
Semi-flex knee joints	Right knee joint is more extended
Slight anterior tilt of the pelvis	Slight anterior tilt of the pelvis
Lumbar spine – slight lordosis	Lumbar spine – slight lordosis
Thoracic spine – slight kyphosis	Thoracic spine – slight kyphosis
Cervical spine – slight lordosis	Cervical spine – slight lordosis
Shoulders - forward	Shoulders – forward
Head – slightly tilted forward	Head – slightly tilted forward

Table 13 - Posture evaluation between left and right side, side view

Anterior view: (Photo number eight)

- He is more stable
- Smaller base
- Slight External rotation of feet
- Patellae are in the same high
- Pelvis - anterior superior iliac spines are equal
- Right Thoraco-Lumbar triangle is slightly bigger
- Nibbles are in the same level
- Left shoulder joint is slightly higher

- Head is in neutral position

#### Breathing Pattern:

The patient has mostly abdominal breathing pattern. While he is walking his breathing it is more obvious now

#### Standing on two scales:

Left lower extremity → 45kg

Right lower extremity → 45kg

- His body weight it is divided equally after the therapy

#### Gait Evaluation:

The Gait examination was divided into four parts.

#### Normal walking:

- Three points step walking on feet – got improved
- The length of his steps is more symmetrical now
- Feet points forward while he is walking
- Trunk rotation
- His upper extremities are more relax
- Slight movement of scapulas
- Head facing forward

#### Walk on toes:

- Same as in the initial examination

#### Walk on heels:

- It is still painful for him. He could not apply it

### Squat walking:

- The patient was able to apply it just in a distance of one meter.

### Changing position:

- From supine lying position on the floor he is able to go on standing position

## **3.6.2 EXAMINATION OF BASIC MOVEMENT PATTERNS** according to Janda

The results are the same as in initial examination; the only change is with the trunk flexion

Right Side	Left Side
Gluteus Maximus	Gluteus Maximus
Biceps Femoris	Biceps Femoris
Contra lateral Erector Spinae	Contra lateral Erector Spinae

Table 14 – Description of muscle timing on right and left side during hip Extension

Right Side	Left Side
Gluteus Medius	Gluteus Medius
Gluteus Minimus	Gluteus Minimus
Tensor Fasciae Latae	Tensor Fasciae Latae
Quadratus Lumborum	Quadratus Lumborum
Iliopsoas & Rectus Femoris	Iliopsoas & Rectus Femoris
Abductors	Abductors
Back muscles	Back muscles

Table 15 – Description of muscle timing on right and left side during hip ABD

Deep neck Flexors
Superficial Flexors

Table 16 – Description of muscle timing during neck flexion

Abdominals
Hip Flexors - Iliopsoas
Back muscles

Table 17 – Description of muscle timing during trunk flexion

### 3.6.3. Evaluation of Range of Motion (all joints)

ROM according to Kendall, in all joints [8]

The measurements were done according to ISOM method

Range of Motion		Joints		Range of Motion
Right Side				Left Side
S 10°-0°- 125°		Hip joint		S 10° - 0° - 125°
F 40° - 0° - 15°				F 40° - 0° - 15°
Rs 40° - 0° - 25°				Rs 40°- 0° - 25°
S 0°- 0° - 140°		Knee joint		S 0°- 0° - 140°
S 10° - 0° - 45°		Ankle joint		S 10° - 0° - 45°
Rs 25° - 0° - 30°				Rs 25° - 0° - 25°

Table 18 –Evaluation of ROM at L.E. during active movements, on left and right side

Range of Motion Right Side	Joints	Range of Motion Left Side
S 15°-0°- 125° F 45°- 0°- 20° Rs 45° - 0° - 30°	Hip joint	S 15° - 0° - 125° F 45° - 0° - 20° Rs 45°- 0° - 30°
S 0°- 0° - 140°	Knee joint	S 0°- 0° - 140°
S 10° - 0° - 45° Rs 25° - 0° - 30°	Ankle joint	S 10° - 0° - 45° Rs 25° - 0° - 30°

Table 19 – Evaluation of ROM at L.E. during passive movements on left and right side

Range of Motion Right Side	Joints	Range of Motion Right Side
S 45°- 0°- 180° F 180° - 0° - 0° Rs 90° - 0°- 70°	Shoulder joint	S 45°- 0°- 180° F 180° - 0° - 0° Rs 90° - 0°- 70°
S 0°- 0°-145°	Elbow joint	S 0°- 0°-145°
S 90°- 0°- 90°	Forearm	S 90°- 0°- 90°
S 80°- 0°- 70° Rs 35° - 0° - 20°	Wrist joint	S 80°- 0°- 70° Rs 35° - 0° - 20°

Table 20 – Evaluation of ROM in U.E. during active movement, on right and left side

Range of Motion		Joints		Range of Motion
Right Side				Right Side
S 45°- 0°- 180°		Shoulder joint		S 45°- 0°- 180°
F 180° - 0° - 0°				F 180° - 0° - 0°
Rs 90° - 0°- 70°				Rs 90° - 0°- 70°
S 0°- 0°-145°		Elbow joint		S 0°- 0°-145°
S 90°- 0°- 90°		Forearm		S 90°- 0°- 90°
S 80°- 0°- 70°		Wrist joint		S 80°- 0°- 70°
Rs 35° - 0° - 20°				Rs 35° - 0° - 20°

Table 21 – Evaluation of ROM in U.E. passive movements, on right and left side

### 3.6.4 Examination of shortened muscles:

According to Kendall we provide muscle length tests [8]

- The results are the same on both sides
- M. Triceps surae – gastrocnemius (10)
- soleus (> 10)
- Hamstrings – (= 80)
- Hip flexors – iliopsoas (0)
- Rectus femoris ( 80)
- Sartorius (hip ABD, F, ER, knee F)
- Tensor fasciae latae (hip ABD, F, IR, knee E)

- M. Rectus abdominis
- Hip adductors – one joint ( >45) – two joint flexors (45)
- Knee flexors – one joint – two joint flexors (80 straight knee – 90 bend knee)
- Back muscles – bend forward in sitting position with extended knees (10cm), with flexed knees (<10cm)
- M. Quadratus lumborum – trunk lateral flexion
- M. Pectoralis major (> 0 and soft barrier)
- M. Pectoralis minor
- Cervical lateral flexion (45)
- Levator scapulae (F, R, LF – depression of scapula)
- M. Sternocleidomastoideus (E, R, LF)
- Scalene muscles (R 45, E)

\*Hamstrings are stretch



### 3.6.5 Muscle strength test – according to Kendall [8]

MUSCLES	INNERVATION	FUNCTION	GRADE EVALUATION	GRADE EVALUATION
			RIGHT SIDE	LEFT SIDE
Peroneus Longus	Superficial Peroneal n.	Pronation, Plantar Flexion and Abduction of the leg	4	3+
Peroneus Brevis	Superficial Peroneal n.	Plantar Flexion, Eversion	4	3+
Tibialis Anterior	Deep Peroneal n.	Dorsiflexion, Inversion	4	3+
Tibialis Posterior	Tibial n.	Plantar Flexion, Inversion	4	3+
Iliopsoas	Lumbar Plexus, Femoral n.	Flexion, Rotation of thigh medially, Flexion of vertebral column	4	3+
Rectus Abdominis	Intercostal nn. VI-VII	Compresses abdomen and flexes vertebral column	3+ slight lordotic posture	3+ slight lordotic posture
Transversus Abdominis	Intercostal nn. VII-XII, Iliohypogastric n., Genitofemoral n.	Compresses abdomen	4 -	4 -
External oblique lateral fibers	Intercostale nn. IV-XII	Bend vertebral column laterally, rotation of vertebral column	4 -	4 -
External oblique anterior fibers	Intercostale nn. IV-XII	Bend vertebral column laterally, rotation of vertebral column	4 -	4 -
Internal Obliques	Intercostale nn. VIII-XII	Flatten the abdominal wall and compress the abdominal viscera	4 -	4 -

Tensor Fasciae latae	Gluteus Superior n.	Abducts, Flexes, Internally rotates the hip and extends the knee	4	4
Sartorius	Femoral n.	Flexion of knee, flexes hip and rotate femur laterally	4	4
Pectoralis Major (Upper & Lower)	Pectoral nn., Thoracic anterior nn.	Flexes, adducts, rotates arm medially	5	5
Pectoralis Minor	Pectoral nn.	Lowers shoulder blade	5	5
Medial Rotators of Shoulder	Peripheral n.	Medial rotation of shoulder blade	5	5
Serratus Anterior	Thoracic longus n.	Stabilises scapula when hand exerts pressure on an object	4	4
Biceps Brachii	Musculocutaneus n.	Flexion and supination of forearm	5	5
Brachioradialis	Radial n.	Flexes, semi-supinate and semi-pronate the forearm	5	5
Supinator	Radial n.	Supinates forearm and hand	5	5
Triceps Brachii and Anconeus	Radial n.	Extends forearm and arm	5	5
Pronator Teres	Median n.	Pronates and flexes forearm	5	5
Pronator Quatratus	Median n.	Pronates the forearm and hand	5	5
Flexor Carpi Radialis	Median n.	Flexion of the hand	5	5

Flexor Carpi Ulnaris	Ulnar n.	Flexion of the hand	5	5
Extensor Carpi Radialis Longus & Brevis	Radial n.	Extension of the hand	5	5
Extensor Carpi Ulnaris	Radial n.	Extension of the hand	5	5
Posterolateral Neck Extensors	Cervical plexus	Posterolateral extension of neck	4	4
Upper Trapezius	Accessory n.	Elevate clavicle, adducts, elevates and rotates scapula outwards, and extends head	5	5
Back Extensors	Brachial plexus	Extension of back	4 slight kyphosis on thoracic spine	4 slight kyphosis on thoracic spine
Deltoid Anterior	Axillary n.	Abduct, flex, extend, medially and laterally rotates arm	4	4
Neck Flexors Anterior	Cervical plexus	Flexion of the head	4	4
Anterolateral Neck Flexors	Cervical plexus	Anterolateral flexion of the neck	4	4
Quadratus Lumborum	Subcostal n., fibers of Lumbar plexus	Side flexion	4	4
Latissimus dorsi	Thoracodorsal n.	Extends, Adducts and rotates arm medially. Moves arm downwards and upwards	5	5

Romboids & Levator Scapulae	Dorsalis scapulae n.	Adduct scapula and raises shoulder blade	4	4
Middle Trapezius	Accessory n.	Lift clavicle, adduct, elevate and rotates scapula outward. Extend head	4	4
Lower Trapezius	Accessory n.	Lift clavicle, adduct, elevate and rotates scapula outward. Extend head	4	4
Teres Major	Suprascapular n.	Extends arm, assists in adduction and medial rotation of arm	4	4
Subscapularis	Subscapular n.	Medial rotation of shoulder joint	4	4
Gluteus Medius	Gluteus superior n.	Adduction of hip joint	4	4
Gluteus Minimus	Gluteus superior n.	Adduction of hip join	4	4
Hip Adductors	Obturator nerve	Adduction of hip join	3+	3+
Soleus	Tibial n.	Plantar flexes foot	4	4
Gluteus Maximus	Gluteus inferior n.	Extends and rotates thigh laterally	3+	3+
Quaticeps Femoris	Lumbar and Sacral plexus	Extension of hip	4	4
Gastrocnemius & Plantaris	Tibial n.	Plantar flexes foot and flexes knee	4	4
Ankle Plantar Flexors	Tibial n.	Ankle plantar flexion	4	3

Shoulder Lateral Rotators	Brachial plexus	Lateral rotation of shoulder	4	4
Teres Minor	Axillary n., Suprascapularis n.	Lateral rotation of shoulder joint	4	4
Shoulder Medial Rotators	Brachial plexus, C6	Medial rotation of shoulder joint	4	4
Popliteus	Tibial n.	Medial rotation of tibia on the femur and flexion of knee joint	4	4
Semitendinosus & Semimembranosus	Tibial n.	Flexes leg and extends thigh	4	4
Biceps Femoris	Tibial n., Peroneal n.	Flexes leg and extends thigh	4	4

Table 22 - Muscle strength evaluation, on right and left side

### 3.6.6 Basic Neurological Examination:

- Examination of movement patterns (Gait analysis, breathing, Prof. Janda test) – The results are written on the final kinesiological examination during inspection
- Babinsky test → Plantar response L4-5 to S1-2 → same as in initial examination

REFLEXES	Main Spinal Nerve Roots	Grades on Right Side	Grades on Left Side
Biceps Brachii	C5	2	2
Brachioradialis	C6	2	2
Triceps Brachii	C7	2	2
Flexors of hand	C8	2	2
Patellar	L2-L4	1+*	1+*

Table 23 - Scale of Deep tendon Reflexes

Reflexes – Are still pathological on Lower Extremities, but patellar reflex is slightly visible now on both sides

\*Very slight activation of the tendon

- Sensation test → Deep and Superficial

#### Deep Sensation

Both examinations were performed in lying position the first at supine position and the second at prone position

- Movement sensation on toes → The subject sometimes was able to say when the movement started, ended and at which toe was applied, but sometimes he was not able to describe the above movements. At the left L.E. the problem of recognizing the movement and the touch was bigger.

### Superficial Sensation

- Sensation on soles → The patient was able to feel the touch at his soles. During the examination in some cases he was really sensitive. The sensitivity is increased at the left sole. The areas he is more sensitive are C4 and L5 dermatomes
- Sensation on arms and back, by Graphesthesia. He was able to understand the numbers were drawing at his body and the touch
- The results of deep and superficial examination are the same as in initial examination
- Metric distance function – physiological
- Tension tests, Lasegue sign – physiological
- Examination of extremities (position, patterns, atrophies, active mobility, passive mobility, resistance examination) – Good. The results are written analytic on the initial examination
- Cranial nerve reflexes → No changes, the results are the same as in initial kinesiological examination. See Table 6

### **3.6.7 Special tests – Balance tests:**

#### Trendelenburg test:

I asked from my patient to provide this test on both sides. I observed that he does not have so much tilt on the left side as he had during the initial kinesiological examination

#### Romberg test

Rhomberg I – no visible movement

Rhomberg II– slight play of muscles on leg and small swaying movement of body

Rhomberg III –instability: had to step forward and open eyes to stabilize self– pathological

Walk on line – He is not losing his balance so much

Vele's test → Negative

### **3.6.8 Palpation:**

I provided palpation to upper trapezius muscles on both sides; because the patient had some trigger points. The trigger points were release, during the third session. According to the patient he does not feel any pain at the present state

### **3.6.9 Subjective response:**

The patient after the examination was feeling well. He was cooperating with me and he was really helpful. Furthermore he said that after all the sessions we had he feels improvement and more strength and stability. He was satisfied from the therapy.

### **3.6.10 Conclusion of examination:**

According to the final kinesiological examination, the patient's stability, walking, and the weakness he had on the lower extremities muscles had all improved. In the area of the upper trapezius muscle, the trigger points were released from the third session of the therapy. Therefore, the patient is not in pain any more. The patient now breathes better and he also improved his body posture. Despite this improvements the patient still suffer from dysesthesia at his soles and hyperesthesia at his toes.

## **3.7 Evaluation of the Effect of the Therapy:**

GBS varies in severity from person to person. Based on that the physical therapy may assist with recovery, but it cannot alter the course of the disease. Since my patient does not have



any limitation with his ROM, the therapy included stabilization exercises, positioning, and light exercises for muscle strengthening according to Kendal [8], stimulation of the proprioceptors and exteroceptors [19] and gait training [7]. In addition I worked at patient's trigger points at his upper trapezius muscles with soft tissue techniques and PIR according to Lewit [11] and by breathing exercises. It is good to note that the whole therapy was NOT overloaded and I limited the overexertion and fatigue to avoid exacerbation of symptoms. It is good to mention that the therapeutic pool may be indicated to initiate movement without the effects of gravity as well as to improve patient's stability

According to the initial kinesiological examination and the final kinesiological examination during inspection the patient is standing in smaller and more stable base, his weight is shifted equally on both sides, his feet point more forward compared to before that he had an E.R. of feet and his left shoulder is not as high as it was at the initial examination. Moreover he improved his gait. From the two points step, now he achieved a three points step walking. Also the length between his steps it is more symmetrical, his U.Es. were relaxed, he has trunk rotation and his breathing is more obvious. Furthermore now he is able to provide a squat walking for a distance of one meter, in contrast with the initial examination where he was not able to provide it. In addition the subject is able to go from supine position on the floor to standing position, which during the first session he noticed that he was afraid and that he was not able to lay down on the floor and then stand up.

The trigger points at upper trapezius muscles were released after the PIR and Soft tissue techniques during the third session.

In my opinion the most effective therapy was the training of walking and stability and the stimulation of proprioceptors and exteroceptors.

At the beginning of the therapy, the patient faced some difficulties during his gait, where he was not able to apply the squat walking. Furthermore he was afraid and he could not sit on the floor and then stand up. Also he had some difficulties during the training of breathing wave, where he could not find the correct rhythm. In contrast during the sessions the patient achieved to face all the previous difficulties that he had and he was able to provide them afterwards.

Despite the therapy and the good effects we achieved, there were some things we did not succeed to improve such as to change patient's breathing pattern, and to improve patient's reflexes. Also during the therapy the subject was not able to walk on heels because he had pain while he was applying it. Moreover he still has dysesthesia at his soles and paresthesia at his toes. A change it is also noted at movement patterns examination during hip extension and trunk flexion from where

Right Side	Left Side
Gluteus Maximus	Biceps Femoris
Biceps Femoris	Contra lateral Erector Spinae
Contra lateral Erector Spinae	Gluteus Maximus

Table 24 – Initial kinesiological examination,  
Description of muscle timing on right and left  
side during hip Extension

Right Side	Left Side
Gluteus Maximus	Gluteus Maximus
Biceps Femoris	Biceps Femoris
Contra lateral Erector Spinae	Contra lateral Erector Spinae

Table 25 – Final kinesiological examination,  
Description of muscle timing on right and left  
side during hip Extension

TRUNK FLEXION
Hip Flexors - Iliopsoas
Abdominals
Back muscles

Table 25 - Final kinesiological examination, description of muscle timing on trunk flexion

TRUNK FLEXION
Abdominals
Hip Flexors - Iliopsoas
Back muscles

Table 26 - Initial kinesiological examination, description of muscle timing on trunk flexion

- Based on the ROM examination it is been achieve a full ROM at the follow joints:

Left hip joint during active movement from:

F 45°- 0° - 15° → F 45°- 0° - 20°

Rs 45°- 0° - 25° → Rs 45°- 0° - 30°

Left ankle joint during active movement from:

Rs 25°- 0° - 25° → Rs 25°- 0° - 30°

- Changes may be also observed during the muscle length test in which hamstrings from < 80° now are = 80°
- At the muscle strength test left peroneus longus and brevis muscles, left tibialis anterior and posterior, left iliopsoas, both gluteal maximus, left ankle plantar flexors, rectus abdominis, external obliques laterar and anterior and internal obliques muscles got stronger.

- Finally at the neurological examination it is noticed a slight movement at patellar reflexes L2-L4 on both lower extremities from 0 to 1+, also while the patient is walking on line he is more stable.

### **3.8 Prognosis:**

According the above therapy the patient will be able to recover soon. Day by day he will be more stable, stronger and as time passes he will improve more his gait and his body posture. In contrast the dysesthesia at his soles, the paresthesia at his toes and the reflexes at his LEs will may improve slightly but he want be able to recover completely. Usually in cases of GBS it is really difficult and rare to regain full the reflexes and especially after such a long time of therapy.

#### **4 Conclusion:**

The therapy was successful. My patient with diagnosis of GBS and I, as his therapist are satisfied with the results. The patient was well motivated and always followed my instructions and cooperated with me fully during all the therapeutic sessions in the clinic and by self therapy at home. After seven sessions of therapy, the patient made great improvement but has to continue with therapy for even better results, because the time we had together during my practice was limited. I can only recommend a similar program of therapy for the rehabilitation of this diagnosis, since the subject get's better after every session.

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## **6 Supplements:**

### Table of Supplements

List of Abbreviations.....	i
List of Tables.....	iv
Photo documentation of subject in Special Part.....	vi
Application for Ethics Board Review.....	x
Patient Consent Form (Czech) .....	xi

## **List of Abbreviations:**

GBS → Guillain-Barré Syndrome

UVN → Ústřední vojenská Nemocnice, Military hospital

AIDP → Acute Inflammatory Demyelinating Polyneuropathy

MFS → Miller Fisher Syndrome

AMAN → Acute Motor Axonal Neuropathy

AMSAN → Acute Motor – Sensory Axonal Neuropathy

BBE → Bickerstaff's brainstem encephalitis

US → United States

TIV → Flu shot or injection of trivalent

LAIV → Nasal spray of live attenuated influenza vaccine

NCS → Nerve conduction study

SPECT → Single photon emission tomography

PET → Positron emission tomography

MRI → Magnetic resonance imaging

CNS → Central nervous system

PNS → Peripheral nervous system

BMI → Body mass index

ROM → Range Of Motion

PIR → Post Isometric Relaxation

PNF → Proprioceptive Neuromuscular Facilitation

EMG → Electromyography

L.E.E. → Left lower extremity

R.L.E → Right lower extremity

L.E (s) → Lower Extremities

U.E (s) → Upper Extremities

E → Extension

F → Flexion

ABD → Abduction

ADD → Adduction

IR → Internal rotation

ER → External rotation

R → Rotation

LR → Lateral flexion

nn. → Nerves

n. → Nerve

M. → Muscle

= → Equal

> → Greater

< → Less

L2-4, S1-2, C5-8 → Segments/Myotoms (Spinal nerve roots) → L – Lumbar area, S – Sacral area, C – Cervical area

I.S.O.M. or S.F.T.R → International standard orthopedic measurements → S – Sagittal plane,

F – Frontal plane, T – Transversal plane, Rs – Rotation is sagittal plane

S.O.A.P. → Is a commonly used record to write daily notes: S: Subjective, O: Objective,

A: Assessment, P: Plan

## **List of tables**

### **Initial Kinesiological Examination**

Table 1 Evaluation between left and right side during inspection.....	26
Table 2 Movement pattern of Hip Extension on Right and Left side.....	28
Table 3 Movement pattern of Hip ABD on Right and Left side.....	29
Table 4 Movement pattern of Neck Flexion.....	29
Table 5 Movement pattern of Trunk Flexion.....	29
Table 6 Active movement of ROM for both lower extremities.....	30
Table 7 Passive movement of ROM for both lower extremities.....	30
Table 8 Active movement of ROM for both upper extremities.....	31
Table 9 Active movement of ROM for both upper extremities.....	31
Table 10 Muscle strength evaluation.....	33
Table 11 Scale of deep tendon reflexes.....	38
Table 12 Cranial nerve reflexes.....	39

## **Final Kinesiological Examination**

Table 13 Evaluation between left and right side during inspection.....	60
Table 14 Movement pattern of Hip Extension on Right and Left side.....	62
Table 15 Movement pattern of Hip ABD on Right and Left side.....	62
Table 16 Movement pattern of Neck Flexion.....	63
Table 17 Movement pattern of Trunk Flexion.....	63
Table 18 Active movement of ROM for both lower extremities.....	63
Table 19 Passive movement of ROM for both lower extremities.....	64
Table 20 Active movement of ROM for both upper extremities.....	64
Table 21 Active movement of ROM for both upper extremities.....	65
Table 22 Muscle strength evaluation.....	71
Table 23 Scale of deep tendon reflexes.....	72
Table 24 Movement pattern of Trunk flexion.....	76
Table 25 Summary of the improvements on the Trunk flexion.....	76

## Photo documentation of therapy in Special Part



Figure 1 Posture examination, posterior view before the therapy



Figure 2 Posture examination, posterior view after the therapy



Figure 3 Right side view before the therapy



Figure 4 Right side view after the therapy





Figure 5 Left side view before the therapy



Figure 6 Left side view after the therapy



Figure 7 Anterior view before the therapy



Figure 8 Anterior view after the therapy

## INFORMOVANÝ SOUHLAS

V souladu se Zákonem o péči o zdraví lidu (§ 23 odst. 2 zákona č.20/1966 Sb.) a Úmluvou o lidských právech a biomedicině č. 96/2001, Vás žádám o souhlas k vyšetření a následné terapii. Dále Vás žádám o souhlas k nahlížení do Vaší dokumentace osobou získávající způsobilost k výkonu zdravotnického povolání v rámci praktické výuky a s uveřejněním výsledků terapie v rámci bakalářské práce na FTVS UK. Osobní data v této studii nebudou uvedena.

Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl.

Prohlašuji, že jsem shora uvedenému poučení plně porozuměla a výslovně souhlasím s provedením vyšetření a následnou terapií.

Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum:.....

Osoba, která provedla poučení:.....

Podpis osoby, která provedla poučení:.....

Vlastnoruční podpis pacienta /tky:.....